Responding to COVID-19 requires strong epidemiological evidence of environmental and societal determining factors

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and associated COVID-19 have caused a global emergency that requires an engaged, integrated, interdisciplinary, and rapid response from the scientific community. Climate change, ecological change, and biodiversity loss might have played an important role in the occurrence of this zoonotic pandemic. Climatic and environmental factors, such as temperature, humidity, and air pollution, are potentially influencing the transmission, spread, and severity of SARS-CoV-2 infection. Strong scientific evidence about the contributions of these environmental determinants in the COVID-19 pandemic is needed, in combination with an understanding of the role of other important societal factors and public health interventions. This evidence will support the public health community in responding to the current crisis, and inform strategies to prevent the recurring effects of the COVID-19 pandemic and future emergencies.

To respond to such urgent needs, public agencies, charity-funded agencies, and scientific journals have made rapid response calls for research projects and publications. The urgency to understand the pandemic has been positive and has allowed rapid approaches to conducting studies and reviewing article submissions. This speed has, however, also led to an overwhelming availability of findings that are somewhat inconsistent across regions, countries, and communities. We do recognise the urgent need to understand the COVID-19 pandemic and the contribution of environmental, population, and societal aspects to this global public health emergency. Our concern, as a community of environmental epidemiology and public health researchers, is that this rapidity of publication and peer review has made possible the publication of studies that are simple to do and understand, but are inadequate at addressing the complexity, drivers, and impacts of the pandemic. Such studies have been captivating for the media and the general public, but could be considered to contribute more to noise than to a robust epidemiological evidence base.[1] More importantly, these studies risk misinforming the public on science and policy, and could disorient public opinion on crucial issues such as global environmental health.

Among the complex environmental influences on the occurrence and spread of SARS-CoV-2, those related to climate change are of primary importance, but are potentially indirect and therefore more difficult to document, similar to other infections linked to climate (eg, malaria, cholera, and Ebola virus). These environmental influences are subject to a wide range of modifying (precluding, constraining, and amplifying) effects via factors and processes, such as the characteristics of hosts, vectors, and pathogens, the prevailing ecological and social conditions, and coexistent changes (local and global) in social, economic, behavioural, and environmental factors.[2] Previous, non-COVID-19-related studies associating infectious disease to climatic conditions have considered these factors in their study designs.[3] The role of other potential environmental determinants of COVID-19, including air pollution and other environmental pollutants, might become clearer within similar comprehensive epidemiological frameworks.

To address this pandemic, we will need to understand its driving factors, which means systematically observing many aspects of COVID-19 at a global, regional, and community level is necessary. We recommend epidemiological studies that consider multi-level investigations of reliable and representative environmental, societal, and population determinants, and use accurate ways to define COVID-19 cases, and study designs that provide robust scientific evidence.[4] Published studies with ecological or simplified designs are useful to explore or generate hypotheses related to the environmental aspects of COVID-19. However, environmental, epidemiological studies are now required to infer association or causality by adequately controlling for the determining factors of COVID-19. Behavioural, societal, and community interventions and control measures, socioeconomic factors and the effects of population mixing, multiple environmental determinants, and the use of appropriate spatial and temporal resolution and time frames, need to be carefully investigated. Most importantly, current and

future epidemiological studies should account for the differences, and varying accuracy, in the COVID-19 case and mortality definitions,[5] the timing of, or delay in, reporting,[6] the evolutionary phases of the pandemic, and the differences in data availability between and within regions, countries, and communities, and with time. These studies must address issues of transparency that allow reproducibility, including the clear reporting of the data source and the code of models used.[7]

We welcome the interest in the environmental aspects of COVID-19 from across the scientific community. We hope that this crisis will highlight the need for integrated systems of environmental and health information, and interdisciplinary, collaborative environmental and health research, and the important service this research provides to the public health community. Worldwide, science has become the leading criterion by which many policy makers decide their response to the pandemic. We must, therefore, use this opportunity for the scientific community to undertake research that optimally informs policy making in view of a healthy and sustainable future at local, regional, and global levels.

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